

ORIGINAL ARTICLE

First experiences with laparoscopic assisted distal gastrectomy: in the view of comparison with high volume centers

Ye Seob Jee

Department of Surgery, Dankook University Hospital, Dankook University College of Medicine, Cheonan, Korea

Purpose: Recently, the number of laparoscopic gastric surgeries increased in Korea. But since many patients prefer to attend larger hospitals, most operations have been performed in high volume center by experienced surgeons, and also most reported studies on laparoscopic gastric surgery have been performed in these hospitals. For better health service and increased access of local residents, district hospitals that have a smaller number of surgical cases also need to perform this surgery safely. **Methods:** We retrospectively analyzed 58 patients who underwent laparoscopic assisted distal gastrectomy (LADG) from April 2009 to January 2012 in Dankook University Hospital. We compared our data with the retrospective data of the Korean Laparoendoscopic Gastrointestinal Surgery Study (KLASS) group because we thought the KLASS study was a representative study of LADG. **Results:** A total of 58 patients underwent LADG during a period of 32 months. The male to female ratio, mean age and body mass index were 34:19, 62.4 years and 23.0 kg/m², respectively. More than D1 + β lymph node was dissected in all patients and the mean number of harvested lymph nodes was 31.4. Mean operation time, estimated blood loss and mean hospital stays were 235 minutes, 176 mL and 7.4 days respectively. During the operation, there were no complication and no conversions to open surgery. After the operation, there were 2 cases of wound complication and 1 case of intra-abdominal abscess which improved with conservative treatment and there was no mortality. These data were not different to the data of high volume centers, especially KLASS. **Conclusion:** We report first experience with LADG and concluded that LADG could be performed safely in smaller scale hospitals.

Key Words: Stomach neoplasms, Laparoscopy

INTRODUCTION

Although the incidence of gastric cancer is decreasing worldwide, gastric cancer is the second most common cancer after thyroid, the 3rd most common cause of can-

cer-related deaths, and affected over 29,000 people in Korea in 2009 [1]. The multidisciplinary treatment of gastric cancer is evolving at a rapid rate and recently there has been an increase in the survival rate and a reduction of the morbidity and mortality rates after surgery [1,2]. Surgical

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Correspondence to: Ye Seob Jee
Department of Surgery, Dankook University Hospital, Dankook University College of Medicine, 201 Manghyang-ro, Dongnam-gu, Cheonan 330-180, Korea
Tel: +82-41-550-3873, Fax: +82-41-550-3928, E-mail: ysjee@dkuh.co.kr

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techniques including minimal invasive surgery have been one of the fastest advancements in the treatment of gastric cancer [2]. Since the first reported performance of laparoscopic assisted distal gastrectomy (LADG) for gastric cancer, in 1991, the use of laparoscopic surgery has been increasing greatly and its safety is widely accepted [3-5]. According to a nationwide survey in 2009 by the Korea Gastric Cancer Association, the number of operations for gastric cancer was more than 14,000 in Korea and about 25% of these were done by laparoscopic surgery [6]. Also, many studies on laparoscopic surgery have been reported and it has been accepted as a safe procedure and it has advantages compared with conventional open gastrectomy [4,5]. However, since many patients tend to prefer to attend high volume centers, most operations have been performed in high volume centers by experienced surgeons in Korea. In fact, 44.8% of all gastric cancer surgery was conducted at six high volume centers in 2009, with other hospitals conducting only a small number of these cases [6]. Also, most reported studies associated with laparoscopic gastric surgery including the Korean Laparoendoscopic Gastrointestinal Surgery Study (KLASS) group trial have been conducted in these hospitals [4,5,7]. For the provision of better health services and increased access of local residents to this type of surgery, district hospitals, that have a smaller number of cases of this surgery than high volume center, also need to carry out this surgery safely and the safe performance of this surgery must be verified. Therefore, we reported our first experience with laparoscopic distal gastrectomy in Dankook University Hospital which is a low volume center than a high volume center. We compared our data with the retrospective data of the KLASS group because we thought the KLASS study was a representative study of LADG and it included most high volume centers.

METHODS

From April 2009 to December 2011, we retrospectively analyzed a total of 58 patients who underwent laparoscopic distal gastrectomy for gastric cancer at Dankook University Hospital. The operations were performed by a

single surgeon who had finished a clinical instructor course of upper gastro-intestinal and minimal invasive surgery at a high volume center which was of 1.1 year's duration. During this period, a surgeon performed about 20 cases of total procedure of LADG and about 100 cases of partial procedure especially, omentectomy and station 4sb and 6 lymph node dissection. This hospital performed more than 300 cases of laparoscopic surgery per year. The indications for surgery were T1N0 (not suitable for endoscopic submucosal dissection), T1N1 on preoperative computed tomography and endoscopic ultrasound, regardless of age and body mass index (BMI). During the operation, lymph node dissection and ligation and division of blood vessels were performed intracorporeally with ultrasonic scissors and laparoscopic clip. After mobilization of stomach, resection of stomach and anastomosis with small bowel were performed extracorporeally through a 4 to 5 cm incision in the epigastric area. Lymph nodes were dissected more than D1 + β (D1 + no. 7, 8a, 9) regardless of the preoperative staging, and the type of reconstruction after distal gastrectomy was Billroth I or Billroth II with jejunojejunostomy. We used data which was collected prospectively and from the surgeon's first case of LADG, and analyzed the patients' characteristics (age, sex and BMI), operative findings (operation time, blood loss and type of reconstruction), pathology results (tumor-node-metastasis staging, harvested lymph node count, metastatic lymph node count) and postoperative outcome (hospital stay, morbidity and mortality). We also compared this data with the retrospective data of the KLASS group. Statistical analyses were performed using SPSS ver. 19.0 (SPSS Inc., Chicago, IL, USA). One-sample t-test was used to compare means, and categorical variables were analyzed using χ^2 of the nonparametric test. To evaluate the learning curve, the operation time was plotted. A plateau phase was estimated from the moving average plotted on the scattergram by using the Loess fit method. A P-value of < 0.05 was considered statistically significant.

RESULTS

A total of 253 patients underwent operation for gastric

Table 1. Patient characteristic and clinical outcome

Variable	Our data	KLASS	P-value
Total	58	1,485	
Male	37 (63.6)	930 (62.7)	
Female	21 (36.2)	554 (37.3)	
Age (yr)	62.2 (31-82)	57.6	0.006
Body mass index (kg/m ²)	23.3 ± 3.4	23.3	0.938
Comorbidity			0.351
None	39 (67.2)	945 (63.9)	
One or more	19 (32.8)	539 (36.3)	
Type of reconstruction			0.327
Billroth I	32 (55.2)	875 (58.9)	
Billroth II	26 (44.8)	384 (25.9)	
Lymph node dissection			0.000
D1 + β (7, 8a, 9)	46 (79.3)	546 (36.8)	
D2 (D1 + 7, 8a, 9, 11p, 12a)	12 (20.7)	827 (55.7)	
Combined resection	3 (5.2)	79 (5.3)	0.630
Gall bladder	2 (3.4)	-	
Ovary	1 (1.7)	-	
Operation time (min)	229.9 ± 57.2	229	0.900
Estimated blood loss (mL)	173.7 ± 138.7	-	
Conversion to open surgery	0 (0)	3 (0.2)	0.349
Morbidity	4 (6.9)	208 (14.0)	0.077
Intraabdominal abscess	1 (1.7)	-	
Ileus	1 (1.7)	-	
Wound	2 (3.4)	-	
Mortality	0 (0)	9 (0.6)	0.793
Hospital stay (day)	7.4 ± 1.9	7-8	0.687
Follow-up period (mo)	16.3 (0.6-34.8)	-	
Recurrence	0 (0)	-	

Values are presented as number (%), median (range) or mean ± SD. KLASS, Korean Laparoendoscopic Gastrointestinal Surgery Study.

cancer and 58 cases (22.9%) of all operation was performed by LADG from April 2009 to January 2012 (over a period of 33 months) and the mean number of operation cases was 21.1 per year. The patients' demographic and surgical results are shown in Table 1. The male: female ratio, mean age and BMI were 34 : 19, 62.4 (±12.2) years and 23.0 (±4.6) kg/m² respectively. Billroth I and Billroth II type reconstruction were performed in 32 (55.2%) and 26 (44.8) patients. The mean operation time, estimated blood loss and mean hospital stays were 235 (±56.0) minutes, 176 (±138.5) ml and 7.4 (±1.9) days respectively. There was no statistical difference with KLASS group except in mean age (KLASS group, 57.6; $P = 0.006$). More than D1 + β lymph node was dissected in all patients and D1 + β lymph node dissection was performed in 46 (79.3%) pa-

Table 2. Pathologic results of patients

Variable	Our data	KLASS	P-value
Tumor size (cm)	2.1 ± 1.2	2.8 ± 1.69	0.000
Retrieved lymph nodes	32.6 ± 14.9	32.0 ± 13.4	0.765
< 15	4 (6.9)	-	
15-30	30 (51.7)	-	
> 30	24 (41.4)	-	
Proximal resection margin	3.7 ± 1.9	-	
T stage (UICC 6th)			
T1a	38 (65.5)	729 (51.4)	0.021
T1b	15 (25.9)	457 (32.2)	0.189
T2a	3 (5.2)	125 (8.8)	0.238
T2b	1 (1.7)	61 (4.3)	0.282
T3	1 (1.7)	45 (3.2)	0.442
N stage (UICC 6th)			
N0	52 (89.7)	1,211 (83.7)	0.145
N1	6 (10.3)	175 (12.4)	0.410
N2	0 (0)	25 (1.8)	0.349
N3	0 (0)	6 (0.4)	0.793
TNM stage (UICC 6th)			
IA	48 (82.8)	1,087 (76.7)	0.175
IB	7 (12.1)	200 (14.1)	0.416
II	2 (3.4)	86 (6.1)	0.305
IIIA	1 (1.7)	31 (2.2)	0.634
IIIB	0 (0)	7 (0.5)	0.748
IV	0 (0)	6 (0.4)	0.793

Values are presented as mean ± SD or number (%).

KLASS, Korean Laparoendoscopic Gastrointestinal Surgery Study; UICC, Union for International Cancer Control; TNM, tumor-node-metastasis.

tients and D2 lymph node dissection in 12 (20.7) patients, and D2 lymph node dissection was performed more frequently in the KLASS group (55.7%) than in our group ($P < 0.001$). But the mean number of harvested lymph nodes, which was 32.6 (±14.9) in our group and 32.0 (±13.4) in the KLASS group, was not different between the groups (Table 2). The pathology results are shown in Table 2. Tumor size in our group was more smaller than in KLASS (2.1 ± 1.2 vs. 2.8 ± 1.69, $P < 0.001$) and the incidence of T1a tumor in our group was higher than in KLASS (65.5% vs. 51.4, $P = 0.021$). The stage frequency was as follows: IA, 48 (82.8%); IB, 7 (12.1%); II, 2 (3.4%); IIIA, 1 (1.7%) and showed no difference with KLASS. During the operation, there were no complications and no conversion to open. After the operation, there were 2 (3.7%) cases of wound complications and 1 (1.8%) case of intra-abdominal abscess, which improved with conservative treatment and

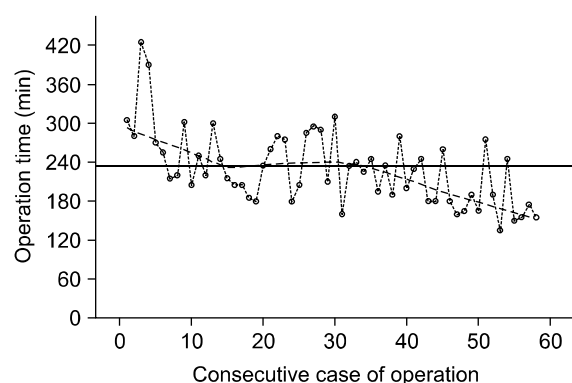


Fig. 1. Operative time is displayed as a linier-plot and plotted a best fit line using the Loess fit method. The weight function used in the Loess method is the tricube weight function. Horizontal line shows mean operation time of Korean Laparoendoscopic Gastrointestinal Surgery Study.

there was no mortality. There is no difference with KLASS in terms of morbidity and mortality. Mean follow-up period was 17.7 months and there were no recurrence of cancer or death related to gastric cancer and the operation. Fig. 1 shows the learning curve according to the operation time. With the first 10 cases, there was a decline in operation time to about 240 minutes and the plateau was maintained until the 30th case and then it declined again after the 30th case. After the 10th case, we reached the mean operation time of KLASS and the horizontal line shows the mean operation time of KLASS.

DISCUSSION

According to a nationwide survey in 2011 by the Korean Gastric Cancer Association, the number of operations for gastric cancer was 14,658, and 3,783 cases (23.3%) were performed by laparoscopy in 2009. And 44.8% of the total operations for gastric cancer were performed in six large volume centers [6]. In the report of the 13th KLGSS group, 2,836 cases of laparoscopic surgery for gastric cancer were performed in 10 large volume centers and the mean number of cases was 283.6 in 2010. These account for 74.9% according to a simple comparison with 2009 nationwide data. Many reports on laparoscopic gastric surgery have been reported and its safety is widely accepted. Additionally, most of these studies, including the KLASS group

since 2008, were conducted in large volume centers [4-6]. Thus, a great percentage of the operations and studies have been performed in several major hospitals. However, although the number of cases have been small for each hospital, many cases of laparoscopic assisted gastrectomy (LAG) have been performed in small volume hospitals. Therefore, to deliver better health service and increase access of local residents, hospitals that have a smaller number of surgical cases of surgery than large scale hospitals need to perform this surgery safely.

The purpose of our study was to determine the safety and feasibility of LAG in low volume hospitals. Our data shows that the total number of cases was 58 during a period of 33 months and the number of cases per year was 21.1. Compared with large volume centers (more than 280 cases per year), this is a very small number of cases but it could represent most small volume hospitals. According to a report on the KLASS group, a total of 1,485 patients underwent LAG from 1998 to 2005 by 10 surgeons. The cases were analyzed retrospectively, and the mean age and BMI were found to be 57.6 and 23.3 and stage frequency was Ia, 76.7%; Ib, 14.1%; II, 6.1%; IIIa, 2.2%; IIIb, 0.5%; and IV, 0.4%. Operation time, mean number of harvested lymph node, hospital stay, morbidity and mortality were 229 minutes, 31.9, 7-8 days (mean hospital stay not shown), 14.0% and 0.6% respectively (Tables 1, 2). Our results were not different or inferior to the retrospective results of the KLASS group in terms of patient demographic and surgical results except for the extent of lymph node dissection. The proportion of D2 lymph node dissection in the KLASS group was more than ours but the total number of retrieved lymph nodes was not different between the two groups. For the pathology results, the rate of T2 and N1 in the KLASS group was higher than ours because the indications for LADG included T2 tumor in the KLASS group but not in ours.

Experience with the operation could be described by the learning curve and Fig. 1 shows the operation time of the first 10 cases declined to 235 minutes and this plateau was maintained until the 30th case, when it declined again. We thought the reason the first 10 cases took longer than the subsequent cases was that the surgeon had not yet adapted to the new operating room, instruments and surgical

team. But after adaptation, the learning curve after 10 cases was shorter than that of reported cases, in which operation time improved from the 50th case and 60 to 90 cases were needed for the learning curve to reach a plateau [8,9]. This reason is because the surgeon in our study was already had gained experience with LAG during his time as a clinical instructor, and therefore, his operation time after 10 cases was similar to those of the KLASS group. After reaching the plateau in the learning curve, operation time decreased constantly, and we inferred that about 20 cases of LAG per year is sufficient for the maintenance of good surgical technique in LAG.

The limitation of our study was that we compared our results with the results of the KLASS group, which had a different time of study. Operations were performed from 2009 to 2012 in our study and from 1998 to 2005 in the KLASS study. Many surgical devices including ultrasonic scissors, surgical stapler, laparoscopic camera and high-definition system are constantly evolving and this fact could have affected our data [2]. But another report that had a similar period to our study showed similar data to ours.

Except for eight to ten high volume centers most hospital have a low volume of laparoscopic gastric surgeries and therefore, we thought our study would have meaningful results. In conclusion, laparoscopic gastric surgery in a low volume center, with about 20 cases per year, could be performed safely and the postoperative results in these centers were not different to those of high volume centers.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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